DFws API User Guide

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Abstract

This guide describes the DFdiscover application programming interface, commonly known as the DFws API, or simply DFws.

The DFdiscover API is a programming resource for users who would like to extend DFdiscover or build connectors from other environments to DFdiscover. Use or understanding of the DFws is not required for successful use of DFdiscover. Most users will never use DFws. This guide is intended for programmers.

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Preface

Considerable familiarity with web application development principles is required. In addition to understanding DFws, successful implementation will require additional web programming skills and frameworks. Those skills and frameworks are not covered in this guide, except in examples to demonstrate use of DFws.

1. Getting Help

DF/Net Research, Inc.'s Technical Support Department can be contacted Monday to Friday between 9:00 am and 5:00 pm Eastern Time via any of the following methods:

55 Head Street, Suite 403
Dundas, Ontario L9H 3H8
Telephone: (905) 522-3282
Email: `<support@datafax.com>`
URL: www.dfnetresearch.com

2. DFdiscover Mailing List

DF/Net Research, Inc. provides an automated email mailing list for tips, help, and interaction with other DFdiscover users.

To subscribe to the mailing list, complete the simple form found at the DFdiscover User's Group mailing list webpage. It is also possible to unsubscribe from the mailing list by visiting the same webpage.

Procedure 1. To submit a message to the mailing list

1. Subscribe to the list. Message submissions are only accepted from members of the list.

2. Create your email message.

3. Send the email message to `<DFUG@datafax.com>`.

3. Conventions

A number of conventions have been used throughout this document.

Any freestanding sections of code are generally shown like this:

```
# this is example code
code = code + overhead;
```

If a line starts with `#` or `%`, this character denotes the system prompt and is not typed by the user.

Text may also have several styles:

• Emphasized words are shown as follows: *emphasized words*.

• Filenames appear in the text like so: `dummy.c`.

• Code, constants, and literals in the text appear like so: `main`.

• Variable names appear in the text like so: `nBytes`.

- Text on user interface labels or menus is shown as: **Printer name**, while buttons in user interfaces are shown as Cancel.

- Menus and menu items are shown as: **File** > **Exit**.

Chapter 1. Introduction

1.1. What is DFws?

DFws is an application programming interface (API) service for DFdiscover. It provides a public, session-based interface to DFdiscover resources.

1.2. How does it work?

DFws executes as a server-side daemon, talking to one or more DFdiscover servers. It provides session management for authenticated clients, accepts resource requests from clients, passes the requests to study database servers, waits for response and then passes the results back to the authenticated client in a response.

For the current release, DFws services are all routed through a server maintained by DF/Net Research, Inc.. For future releases, customers will have the ability to deploy their own DFws server.

1.3. How can we use it?

DFws is most useful to clients that need to interact with DFdiscover at a programmatic level. They need to interact with DFdiscover, retrieving or submitting data, in a way that is not already provided by an existing application (such as DFexplore) or a command-line program.

DFweb and DFcollect are examples of authenticated clients that provide interfaces to DFdiscover and DFdiscover data in unique ways. They both request data from DFws, manipulate it through their interfaces, and submit data through DFws to one or more study databases. The data is available to any user with the appropriate permissions and using any of the DFdiscover tools.

What tools can you create that interface with DFdiscover to solve unique clinical trial data management problems?

Chapter 2. Quick Start with DFws

2.1. Just the Essentials

Before you can develop solutions with DFws, a few essential pieces are needed. These pieces include:

1. Get API access credentials from DFws Admin. The credentials include values for:

    -   *CLIENT_ID*
    -   *CLIENT_PASS*
    -   *CLIENT_SECRET*
    -   *API server base URI*

2. Choose your method of sending HTTPS requests:

    -   Web, Mobile or Desktop application
    -   Unix Script (cURL)
    -   REST API Client apps such as: Postman, Paw, HTTPie, SoapUI, Insomnia REST Client

3. Start sending requests and receiving data.

2.2. PHP Example

This example uses PHP web page scripts to login to a DFdiscover server, namely *explore.dfdiscover.com* using a DFws API server, *dfws.dfdiscover.com*, and request the list of available studies.

An `authorize` API request is sent that includes DFdiscover login credentials and an authorization string to authenticate the API client. A `sessionID` is returned in the response. This `sessionID` is required to send subsequent requests. Additionally, all subsequent requests require encoding.

For the example, there are five files that must be copied to your php web server environment:

-   `index.php`: login page
-   `apirequests.php`: functions to send cURL API calls
-   `studies.php`: studies list page
-   `styles.css`: stylesheet for html rendering
-   `CA.pem`: SSL CA Bundle

These files will require some editing to specify your unique API server access credentials. Also, ensure that your SSL CA certificate file is correctly referenced.

For a full list of available API endpoints, consult Details of all supported API endpoints.

Example 2.1. index.php

```php
<?php
```

```php
$error='';
if (isset($_POST['submit'])) {
        include('apirequests.php'); // INCLUDE FUNCTIONS FILE
        if (empty($_POST['server']) || empty($_POST['username']) ||
 empty($_POST['password'])) {
                $error = "Server, Username and Password must be provided";
        } else {
                $username=$_POST['username'];
                session_start();
                $session_id=login($_POST['server'], $username,
                                            $_POST['password'], $error);
                if (!empty($session_id)) {
                        $_SESSION['session_id']=$session_id;
                        $_SESSION['username']=$username;
                        header("location: studies.php"); // Redirecting To Studies List
                } else {
                        $error = "Username or Password is invalid<br>".$err.$response;
                }
        }
}
?>


<html>
<head>
<title>Login to DFdiscover via DFws</title>
<link href="styles.css" rel="stylesheet" type="text/css">
</head>
<body> <center>
<div id="logo"></div> <div id="main"><h1>Login</h1>
<div id="login" align=left>
<form action="" method="post">
<label>DFdiscover Server:</label><input id="server" name="server" type="text"><br>
<label>Username:</label><input id="name" name="username" type="text"><br>
<label>Password:</label><input id="password" name="password" type="password"><br><br>
<input name="submit" type="submit" value=" Login "><br>
<span><?php echo $error; ?></span>
</form></div></div>
<a href="https://www.dfdiscover.com">www.dfdiscover.com</a>
</center></body>
</html>

// End of file index.php
```

Example 2.2. apirequests.php

```php
<?php

//////////////API Requests Functions ///////////////////////

///////////// Request to authorize and login /////////////
function login($svr, $uid, $pwd, &$err)
{
        $SSL_PEM_FILE = "CA.pem";
```

```php
        $API_PORT= "4433";
        $API_URL= "https://dfws.dfdiscover.com:4433";
        $API_AUTH= base64_encode("CLIENT_ID:CLIENT_PASS");

        $json_str = "{ \n\t\"server\": \"".$svr."\",\n\t\"username\": \"".$uid."\",\n\t
\"password\": \"".$pwd."\",\n\t\"sessionDuration\": \"1\"\n}";
        $curl = curl_init();
        curl_setopt_array($curl, array(
          CURLOPT_SSL_VERIFYPEER => true,
          CURLOPT_SSL_VERIFYHOST => 2,
          CURLOPT_CAINFO => $SSL_PEM_FILE,
          CURLOPT_PORT => $API_PORT,
          CURLOPT_URL => $API_URL."/dfws/v5/authorize",
          CURLOPT_RETURNTRANSFER => true,
          CURLOPT_ENCODING => "",
          CURLOPT_MAXREDIRS => 10,
          CURLOPT_TIMEOUT => 30,
          CURLOPT_HTTP_VERSION => CURL_HTTP_VERSION_1_1,
          CURLOPT_CUSTOMREQUEST => "POST",
          CURLOPT_POSTFIELDS => $json_str,
          CURLOPT_HTTPHEADER => array(
            "authorization: Basic ".$API_AUTH,
            "cache-control: no-cache",
            "content-type: application/json"
          ),
        ));

        $response = curl_exec($curl);
        $err = curl_error($curl);
        $server_resp = json_decode($response);
        curl_close($curl);

        $session_id="";
        if (isset($server_resp->sessionToken))
        {
                $session_id=$server_resp->sessionToken->sessionID;
        }
        return  $session_id;
}

//////////// JWT encoding //////////////
function base64url_encode($data) {
  return rtrim(strtr(base64_encode($data), '+/', '-_'), '=');
}
function encodeJWT($s_id, $u_r_l)
{
        $API_SECRET  = 'CLIENT_SECRET';
        $payload= array('sessionId' => $s_id, 'url' => $u_r_l);
        $header = array('alg' => 'HS256', 'typ' => 'JWT');
        $segments = array();
        $segments[]=base64url_encode(json_encode($header,
                                JSON_UNESCAPED_SLASHES));
        $segments[]=base64url_encode(json_encode($payload,
                                JSON_UNESCAPED_SLASHES));
```

```php
        $signing_input = implode('.', $segments);
        $signature = hash_hmac('sha256', $signing_input, $API_SECRET, true);
        $segments[] = str_replace('=', '', base64url_encode($signature));
        return implode('.', $segments);
}

//////////// Requests requiring JWT ////////////
function reqDFData($sid, $req_url, &$response, &$err)
{
        $SSL_PEM_FILE = "CA.pem";
        $API_PORT= "4433";
        $API_URL= "https://dfws.dfdiscover.com:4433";
        $jwt_str = encodeJWT($sid,$req_url);
        $curl = curl_init();
        curl_setopt_array($curl, array(
                CURLOPT_SSL_VERIFYPEER => true,
                CURLOPT_SSL_VERIFYHOST => 2,
                CURLOPT_CAINFO => $SSL_PEM_FILE,
                CURLOPT_PORT => $API_PORT,
                CURLOPT_URL => $API_URL.$req_url,
                CURLOPT_RETURNTRANSFER => true,
                CURLOPT_ENCODING => "",
                CURLOPT_MAXREDIRS => 10,
                CURLOPT_TIMEOUT => 30,
                CURLOPT_HTTP_VERSION => CURL_HTTP_VERSION_1_1,
                CURLOPT_CUSTOMREQUEST => "GET",
                CURLOPT_HTTPHEADER => array(
                "authorization: Bearer ".$jwt_str,
                "from: CLIENT_ID",
                "cache-control: no-cache"
                ),
        ));
        $response = curl_exec($curl);
        $err = curl_error($curl);
        curl_close($curl);
        if ($err) {
                echo "cURL Error #:" . $err;
                return 0;
        }
        return 1;
}
?>
// End of file apirequests.php
```

Example 2.3. studies.php

```php
<?php

/////////////// GET & SHOW STUDIES LIST ////////////
include('apirequests.php');
session_start();
if ( !isset($_SESSION['username']) ||
        !isset($_SESSION['session_id']) )
{
```

```
        echo '<font color=blue>Session Expired!</font>';
        echo '<br><a href="index.php">Click here to Login</a>';
        exit;
}
$username=$_SESSION['username'];
$session_id=$_SESSION['session_id'];
if (!reqDFData($session_id, "/dfws/v5/studies", $response, $err)) exit;
$server_resp = json_decode($response);
if (is_object($server_resp) && $server_resp->status)
{
        echo '<font color=blue>'.$server_resp->message.'</font>';
        $_SESSION['reason']=$server_resp->message;
        echo '<br><a href="index.php">Click here to Login</a>';
                exit;
        }
?>
<html> <head>
<title>DFdiscover Web - Sample</title>
<link href="style.css" rel="stylesheet" type="text/css">
</head>
<body> <center>
<h2>Studies List</h2>
<?php
foreach ($server_resp as $val)
{
        if (!is_object($val)) continue;
        echo '<div class=study><div align=left>';
        echo $val->studyId."  \t".$val->name;
        if ($val->disabled)
                echo '<font class=study_status color=red>Not Available: '.$val-
>disabledWhy.'</font></div>';
        else if ($val->restricted)
                echo '<font class=study_status color=red> Restricted: '.$val-
>restrictedWhy.'</font>';
        else
                echo '<font class=study_status color=green>Available</font></div>';
         echo '</div> </div> <br>';
 } ?>
</center>
</body>
</html>

// End of file studies.php
```

Example 2.4. styles.css

```
@import http://fonts.googleapis.com/css?family=Raleway;

#main {width:960px;margin:50px auto;font-family:raleway}

span {color:red }

h2 {background-color:#FEFFED;color:#2E2E2E;text-align:center;border-radius:-10px -10px 0
 0;margin:0px 0px;padding:5px}
```

```
hr {border:0;border-bottom:1px solid #ccc;margin:10px -40px;margin-bottom:30px}

#login {width:300px;float:center;border-radius:10px;font-family:raleway;border:2px solid
 #ccc;padding:10px 40px 25px;margin-top:70px}
input[type=text],input[type=password] {width:99.5%;padding:10px;margin-top:8px;border:1px
 solid #ccc;padding-left:5px;font-size:16px;font-family:raleway}

input[type=submit] {width:100%;background-color:#FFBC00;color:#fff;border:2px solid
 #FFCB00;padding:10px;font-size:20px;cursor:pointer;border-radius:5px;margin-bottom:15px}

.study{width: 700px;float:center;border-radius:2px;font-family:arial;border:1px solid
 #E5E4E2;padding:10px 20px 8px;color:#483C32;background: -webkit-gradient(linear, left
 top, left bottom,from(#f2f2f2), to(#f2f2f2));background: -moz-linear-gradient(top,
 #F5F5DC,  #f2f2f2);          }

.study_status{width: 50%;float:right;border-radius:1px;font-size:12px;font-
family:arialnarrow;padding:2px 3px 1px;}

a {text-decoration:none;color:#4863A0;}

// End of file styles.css
```

Chapter 3. Developing with DFws

This chapter provides detailed information for using and programming with the DFdiscover API (DFws API), as well as details of all supported API endpoints.

3.1. Prerequisites

There are two important pre-requisites for using the DFws API:

1. The DFws API is licensed separately from DFdiscover. A valid license with the DFWS feature enabled is required. Contact DF/Net Research, Inc. for licensing information.

2. A DFws API server must be installed and configured. This chapter references the generic DFws API server that is available at `dfws.dfdiscover.com`. For future releases, you may be using your own DFws API service, exposed through your own *dfwsApiServer*.

To access resources from *dfwsApiServer*, clients require a base URI (Uniform Resource Identifier). The base URI is the hostname of the *dfwsApiServer* appended with the service name and the API version. The DFws API supports HTTPS requests only, providing TLS1.2 encrypted communications over the exposed port. DFws API clients must also be aware of the correct port number to use for sending HTTPS requests. In our demo example, we use port number 4433. Together with the generic DFws API server, the correct Base URI to send requests is thus:

```
https://dfws.dfdiscover.com:4433/dfws/v5
```

3.2. API Client Account

Before accessing resources provided by *dfwsApiServer*, clients must have an API Client Account defined in the DFws database. This is typically requested of, and provided by the DFws administrator (which is DF/Net Research, Inc. at this time). The result of that request is a set of API Client Account credentials.

Credentials	Description
client_id	The login username of the API client, used for authorize requests and for all other requests as request sender (From header).
client_pass	The password of the API client used for authorize requests (Encoded with client_id for Authorization header).
client_secret	The passcode to encode API requests requiring a session token (JWT).

3.3. DFdiscover and DFws API

To use API resources, it is important to be familiar with DFdiscover. All DFdiscover clients communicate with a DFdiscover server using an encrypted connection. DFdiscover login credentials are required to establish a connection, which are then followed by data transactions. Each DFdiscover user is provided with the hostname of the DFdiscover server to connect to along with a Username and Password (these are normal DFdiscover user credentials, which are different from the API client account credentials). Once users are logged-in to the DFdiscover server using a client application, the application maintains that session for all database queries to DFdiscover. Similarly, all DFws API requests require an authenticated session that must be initialized using the authorize request. This request serves as an entry point for starting any new sessions to a DFdiscover server via the DFws API.

3.3.1. Sessions

A session is initialized using the `authorize` request and a session is terminated using the `logout` request. Creation of a session provides a unique `sessionID`. All subsequent requests must provide an encoded JWT session token, which includes this `sessionID`.

The following section outlines details of how to compile requests and tokens. A JWT Token is uniquely generated for each API request using an algorithm provided to clients as part of the application distribution. The algorithm requires a `client_secret`, `request_URI` and the `sessionID`. For more information regarding JWT see jwt.io and the JWT generation code examples in this document.

3.4. Getting Started

Each request is sent to the *dfwsApiServer* using HTTPS syntax and semantics. The Header component includes the API client/session information while the Body contains the JSON data of the request.

3.4.1. Authorize request

The `authorize` request starts a new DFws API session for a specific DFdiscover server. In the HTTP Header, the Basic Authorization Header is used to send API client credentials as a base64 encoded string based in the format

```
client_id:client_pass
```

The Body of the request includes JSON containing the DFdiscover server hostname and user login credentials.

Note that the `client_id:client_pass` must be Base64 encoded. This is easily accomplished using a standard base64encode function, e.g., `base64('client_id:client_pass');` (where client_id and client_pass are concatenated with a colon)

Assuming a client_id of "user1" and a client_pass of "X", the base64 encoded result might be `ZGZjb2xsZWN0OjFwYXNzd2Q=`. That result is then included in the HTTPS request body as follows:

```
POST https://dfws.dfdiscover.com:4433/dfws/v5/authorize HTTP/1.1
Authorization: Basic ZGZjb2xsZWN0OjFwYXNzd2Q=
Body: {server:"s1.dfdiscover.com",username:"user1",password:"x"}
```

Response to the request includes the unique sessionID. This sessionID is subsequently required for composing session tokens to be used in subsequent requests. The response has the following appearance:

```
{
  "serverResponse": {
    "isRouterUser": true,
    "isSysAdmin": false,
    "passExpiryDays": 47,
    "server": "s1.dfdiscover.com",
    "timestamp": "2018-03-07T14:55:26",
    "userEmail": "",
    "userFullName": "Firstname Lastname"
  },
  "sessionToken": {
    "expiryDate": "Tue Mar 7 19:58:26 2018 GMT",
    "sessionID": "2116b375-2941-45fa-8a74-19a356e114ec"
  }
}
```

3.4.2. Subsequent Requests

All requests (except authorize, broadcast and log) must provide a From header with client_id and Authorization header with the JWT sessionToken in the format `Bearer ${jwt_token}`. The HTTP request components for studies request are as follows:

```
GET /studies HTTP/1.1
Authorization: Bearer ${jwt_token}
From: ${client_id}
```

for example:

```
GET https://dfws.dfdiscover.com:4433/dfws/v5/studies HTTP/1.1
Authorization: Bearer
 eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzZXNzaW9uSWQiOiIyMTE2YjM3NS0yOTQxLTQ1ZmEtOGE3NC0x
OWEzNTZlMTE0ZWMiLCJ1cmwiOiIvZGZ3ZWJhcGkvdjAvc3R1ZGllcyJ9.yrZJbzubVaG9vfqT19h7fbUfKx7quzzmQ
fPjKfbzplQ
From: dfcollect
```

3.4.3. Logout Request

Every API client is required to logout, thereby terminating the sessionID and closing the connection. To terminate an authorized user's session with a DFdiscover server, make a GET request to logout as follows:

```
GET /logout HTTP/1.1
Authorization: Bearer ${jwt_token}
From: ${client_id}
```

For example,

```
GET https://dfws.dfdiscover.com:4433/dfws/v5/logout HTTP/1.1
Authorization: Bearer
 eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzZXNzaW9uSWQiOiJkOTEwNDU3NS1mN2Q2LTQzNDAtYjhlYy00
ODg2YTk1ODBjZjYiLCJ1cmwiOiIvZGZ3cy92NS9sb2dvdXQifQ==.GR/9EKqwhptEHmpeet5J2CGOBupBnYaZB9bG2
16iZZ8
From: dfcollect
```

HTTP Method	Description
GET	Retrieve resources
PUT	Update resources
POST	Create resources and perform resource actions
LOCK	Acquire resource lock
UNLOCK	Release resource lock

The following resources may be requested.

Request	Description	More Info
POST /authorize	Initialize a new authorized session	Section 3.7.1.1, "Authorize"
GET /logout	Close session	Section 3.7.1.7, "Logout"
GET /studies	Get list of studies	Section 3.7.1.8, "Studies"
GET /studies/:studyNum	Get study status	Section 3.7.1.9, "Study Status"

Request	Description	More Info
GET /studies/:studyNum/visitmap	Get visit map for study :studyNum	Section 3.7.2.5, "Visit Map"
GET /studies/:studyNum/sites	Get sites for study :studyNum	Section 3.7.2.7, "Sites"
GET /studies/:studyNum/ missingmap	Get missing values map for study :studyNum	Section 3.7.2.3, "Missing Map"
GET /studies/:studyNum/ querycategorymap	Get query category map for study :studyNum	Section 3.7.2.4, "Query Category Map"
GET /studies/:studyNum/ lut/:lut_name	Get the study lookup table :lut_name. If there is no matching lookup table, return the matching system lookup table.	Section 3.7.2.2, "Lookup Table"
GET /studies/:studyNum/setup	Get setup for study :studyNum	Section 3.7.2.8, "Setup Definition"
GET /studies/:studyNum/setup/ plates/:plate	Get setup information for a particular plate in the study	Section 3.7.2.9, "Setup Plate"
GET /studies/:studyNum/setup/ plates/:plate/modules/:module_id	Returns module reference object for a particular plate in the study	Section 3.7.2.10, "Setup Module"
GET /studies/:studyNum/setup/ plates/:plate/modules/:module_id/ fields/:field_id	Returns module reference object for a particular field in the study	Section 3.7.2.11, "Setup Fields"
GET /studies/:studyNum/ editchecks	Returns editchecks binary (compiled editchecks) for the study	Section 3.7.2.12, "Edit Checks"
GET /studies/:studyNum/logo	Get the logo for the study	Section 3.7.2.1, "Logo"
GET /studies/:studyNum/ sitesubjects/:site_id?includenew	Get a list of all subjects for the specified site that have records in the database for the specified study. The optional parameter 'includenew' can be specified to also return the next set of subject IDs that are not yet in the databse. The number of new subjects returned matches the value of **Show next [#] New Subject Binders** defined in the study global settings.	Section 3.8.1, "Subject list"
GET /studies/:studyNum/ subjectkeys/:subject	Get a list of all existing record keys (subject, visit, plate, status, and validation level) for a given subject in the database for the specified study	Section 3.8.2, "Keys for Subject"
GET /studies/:studyNum/ sitekeys/:site_id	Get a list of all primary keys that exist for a given site in the database for the specified study	Section 3.8.3, "Keys Available by Site"
GET /studies/:studyNum/keysinfo	Get keys filtered based on parameters	Section 3.8.4, "Status for keys"
GET /studies/:studyNum/records	Get records filtered based on parameters (See detailed description for parameter options)	Section 3.8.5, "Database Records by filter"
GET /studies/:studyNum/ records/:subject/:visit/:plate	Get a record with the given set of keys - subject, visit and plate from database in the specified study	Section 3.8.6, "Database record by keys"
LOCK /studies/:studyNum/ records/:subject/:visit/:plate	Lock a record with the given set of keys - subject, visit and plate from database in the specified study. The lock is held until released, the client exits or session time-out occurs.	Section 3.8.9, "Lock"

Request	Description	More Info
UNLOCK /studies/:studyNum/ records/:subject/:visit/:plate	Release lock on data record with the given set of keys - subject, visit and plate from database in the specified study	Section 3.8.8, "Unlock"
PUT /studies/:studyNum/ records/:subject/:visit/:plate	Update a record with the given set of keys - subject, visit and plate from database in the specified study	Section 3.8.10, "Add/ Update Record"
GET /studies/:studyNum/ documents/:image_id	Get JSON with base64 encoded image file that matches the image_id for the specified study	Section 3.9.1, "Get Document"
PUT /studies/:studyNum/ documents/:subject/:visit/:plate	Upload the specified image file to server for the specified keys in the database for the specified study	Section 3.9.2, "Add Document"
GET /studies/:studyNum/ report/:reportname	Run :reportname for the specified study and return study results	Section 3.7.2.6, "Reports"
GET /licensemetrics	Get license metrics of DFdiscover server	Section 3.11.1, "License Metrics"
GET /featuremetrics	Get feature metrics of DFdiscover server	Section 3.11.2, "Feature Metrics"
GET /users{/:user_name}	Get account detail for all users or specified user :user_name	Section 3.10.3, "User Account"
POST /contactinfo/:user_name	Change current user's own profile	Section 3.10.1, "User Profile"
GET /users/:user_name/userroles	Get user roles for DFdiscover user :user_name	Section 3.10.4, "User Roles"
GET /roles/:studyNum	Get roles defined for study :studyNum	Section 3.10.5, "Study Roles"
GET /roles/:role_id/roleperms	Get role-perms for role :role_id	Section 3.10.6, "Role Permissions"
GET /broadcast	Get broadcast message, login.html contents from DFdiscover server	Section 3.7.1.2, "Broadcast"
GET /keepalive	A connection keep-alive request that resets session expiry timer	Section 3.7.1.6, "Keepalive"
GET /sessions	Get most recent 500 records from internal DFws log. Restricted to DFws admins only.	Section 3.7.1.3, "Log"
GET /closesession	Close an active DFws session. Authorized DFdiscover admin user session must be initialized by the API client in order to close DFws sessions to the DFdiscover server.	Section 3.7.1.5, "Close Session"

3.5. Status Codes

Following is the list of HTTP status codes that may be returned by a DFws API server. For the full list/details of HTTP status codes, see the wikipedia page.

Status Code	Description
200	OK
204	No Content
400	Bad request

Status Code	Description
401	Unauthorized
403	Forbidden
404	No such oject
409	Conflict
500	Internal error
501	Not implemented
503	Service not available
600	Host not found
601	Connection refused
602	Connection closed

3.5.1. Errors

If the API request does not return with a status of `200`, the error is represented as a JSON object with status and error message like this:

```
{
  "status": 403,
  "message": "Forbidden"
}
```

3.6. JWT Code Samples

There are several methods available for generating a JSON web token. Implementation is left to the developer. A few examples are provided here.

Example 3.1. JWT Generation in AngularJS

```
<!-- BEGIN CODE SNIPPET -->
  function createJWT(uri, sessionId) {
    let header = {
      "alg": "HS256",
      "typ": "JWT"
    };
    let payload = {
      "sessionId": sessionId,
      "url": uri
    };
    let secret = 'client_secret'; // Provided to all API clients
    let b64Header = b64Encode(JSON.stringify(header));
    let b64Payload = b64Encode(JSON.stringify(payload));
    let b64Secret = b64Encode(secret);
    return b64Header + '.' + b64Payload + '.' +
      hmacSHA256(b64Header + "." + b64Payload, b64Secret);
  }

  // How to call above function
```

```
  jwt_token = createJWT("/dfws/v5/studies",
        "2116b375-2941-45fa-8a74-19a356e114ec");
<!-- END CODE SNIPPET -->
```

Example 3.2. JWT Generation function in PHP

```
<!-- BEGIN CODE SNIPPET -->
  function create_JWT($uri, $sessionId)
  {
$payload= array('sessionId' => $sessionId, 'url' => $uri);
$header = array('alg' => 'HS256', 'typ' => 'JWT');
$segments = array();
$segments[] = base64_encode(
        json_encode($header,JSON_UNESCAPED_SLASHES));
$segments[] = base64_encode(
        json_encode($payload,JSON_UNESCAPED_SLASHES));
$signing_input = implode('.', $segments);
$signature = hash_hmac('sha256', $signing_input,'client_secret', true);
$segments[] = str_replace('=','', base64_encode($signature));
return implode('.', $segments);
  }

  // How to call above function
  $jwt_token = create_JWT('/dfws/v5/studies',
        '2116b375-2941-45fa-8a74-19a356e114ec');
<!-- END CODE SNIPPET -->
```

Example 3.3. JWT Generation using JWT.IO library (www.jwt.io)

For JWT.IO simply compose payload with 'url' and 'sessionId' and use client_secret to generate token.

```
<!-- Sample Header-->
{
  "alg": "HS256",
  "typ": "JWT"
}
<!-- Sample Payload -->
{
  "sessionId": "929e9444-a028-4a94-8931-e2cbdf4b4a1f",
  "url": "/dfws/v5/studies"
}
```

3.7. Details of all supported API endpoints

3.7.1. Session Management

3.7.1.1. Authorize

Authorize a DFdiscover user and start a new session

Request	POST /authorize

df discover 2018

Example
Response

```
{
    "serverResponse": {
        "cdnUrl": "https://cdn.dfdiscover.com/v5.1",
        "isRouterUser": true,
        "isSysAdmin": true,
        "maxMediaSize": 26214400,
        "passExpiryDays": 140,
        "passRules": {
            "charDigitRequired": true,
            "minLength": 7,
            "specialCharRequired": false,
            "upperLowerRequired": false
        },
        "server": "explore.dfdiscover.com",
        "serverVersion": "5.1.0",
        "timestamp": "2019-01-09T09:33:07",
        "userEmail": "",
        "userFullName": "Example Admin"
    },
    "sessionToken": {
        "expiryDate": "2019-01-09T14:43:07Z",
        "sessionID": "e2e88735-a265-4eb7-b9af-c2afb170f1bd"
    }
}
```

Notes

POST Body JSON	Type	Description
server	string (Required)	Server name (e.g. test.dfnetresearch.com)
username	string (Required)	DFdiscover username
password	string (Required)	DFdiscover password
sessionDuration	integer (Optional)	Connection keep-alive time in minutes. Default is 3 minutes if sessionDuration not provided. Connection terminates if no activity within sessionDuration period

3.7.1.2. Broadcast

Retrieve Login.html contents from DFdiscover server.

Request   `POST /broadcast`

Example
Response

```
{
    "data": "<center>DFdiscover 5.0 running on OpenSUSE 13.2</center>"
}
```

Notes

POST Body JSON field	Type	Description
server	string (Required)	Server name (e.g. test.dfnetresearch.com)

This is an independent request and does not depend on 'authorize' request. For this reason, the API user must pass the Authorization header.

Provide your client credentials in the Authorization header ("Basic "+ client_id:client_secret) where client_id:client_secret is Base64 encoded.

```
GET https://dfws.dfdiscover.com:4433/dfws/v5/broadcast HTTP/1.1
Authorization: Basic ZGZjb2xsZWN0OjFwYXNzd2Q=
```

3.7.1.3. Log

Returns recent 500 records from internal DFws log. Restricted to DFws admins only. Provide your client credentials in the Authorization header ("Basic "+ client_id:client_secret) where client_id:client_secret is Base64 encoded.

```
GET https://dfws.dfdiscover.com:4433/dfws/v5/log HTTP/1.1
Authorization: Basic ZGZjb2xsZWN0OjFwYXNzd2Q=
```

Request	GET /log
| Example Response | ```
[
    {
        "DFDEVLOGIN": "",
        "DFMESSAGE": "Invalid Authorization Token",
        "DFMETHOD": "POST",
        "DFPEER": "::ffff:192.168.4.105",
        "DFSTATUS": 200,
        "DFTIMESTAMP": "20181018193011",
        "DFTYPE": 1,
        "DFURI": "/dfws/v0/authorize",
        "DFUSER": ""
    },
    {
        "DFDEVLOGIN": "",
        "DFMESSAGE": "Invalid API call",
        "DFMETHOD": "POST",
        "DFPEER": "::ffff:192.168.4.105",
        "DFSTATUS": 503,
        "DFTIMESTAMP": "20181018192503",
        "DFTYPE": 1,
        "DFURI": "/dfws/v0/austorize",
        "DFUSER": ""
    }
]
``` |

3.7.1.4. Sessions

Returns details of current active sessions. This request is restricted to DFdiscover admins or DFws admins. The DFws admin can access sessions list in the following ways: Provide the admin credentials in the Authorization header ("Basic "+ client_id:client_secret) where client_id:client_secret is Base64 encoded.

```
GET https://dfws.dfdiscover.com:4433/dfws/v5/sessions HTTP/1.1
Authorization: Basic ZGZjb2xsZWN0OjFwYXNzd2Q=
```

Request	GET /sessions
| Example Response | ```
[
    {
        "apiClient": "dfweb",
        "datafaxServer": "t50suse.datafax.com",
``` |

```
            "duration": 3,
            "expiryTime": "Wed Jul 12 19:57:35 2017 GMT",
            "hostAddresses": [
                {
                    "hostAddress": "::ffff:192.168.4.223",
                    "order": 1
                }
            ],
            "openedStudy": 154,
            "origin": "",
            "sessionID": "c4e6d9f4-7b77-4d88-9455-a16c117179c1",
            "startTime": "Wed Jul 12 19:54:33 2017 GMT",
            "status": "idle",
            "sysAdmin": true,
            "userID": "datafax"
        },
        {

            "apiClient": "dfwebadmin",
            "datafaxServer": "t50centos.datafax.com",
            "duration": 3,
            "expiryTime": "Wed Jul 12 19:56:43 2017 GMT",
            "hostAddresses": [
                {
                    "hostAddress": "::ffff:192.168.4.105",
                    "order": 1
                }
            ],
            "openedStudy": 0,
            "origin": "",
            "sessionID": "54d78cf9-604f-48b6-83c7-add7b142ce04",
            "startTime": "Wed Jul 12 19:52:06 2017 GMT",
            "status": "idle",
            "sysAdmin": true,
            "userID": "datafax"
        }
]
```

3.7.1.5. Close Session

Close an active DFws session. An authorized DFdiscover admin user session must be initialized by the API client in order to close DFws sessions to the DFdiscover server. Therefore, like all non-admin requests, this request requires JWT token in Authorization header as well as client_id in From header.

Request
```
GET /closesession?sessionID=${SESSIONID}
```

Example
Response
```
{
  "logout": true,
  "timestamp": "2016-07-12T12:11:48",
  "message": "Session closed successfully"
}
```

3.7.1.6. Keepalive

A connection keep-alive request that resets the session's expiry timer

Request	GET /keepalive

Example Response	

```
{
    "sessionDuration": 10,
    "status": "OK"
}
```

3.7.1.7. Logout

Terminate an authorized user's connection to a DFdiscover server

Request	GET /logout

Example Response	

```
{
    "logout": true,
    "sessionID": "94e25498-1ea6-401b-80aa-e35ebe1e626d",
    "username": "datafax"
}
```

3.7.1.8. Studies

Request the list of all permitted studies and their status

Request	GET /studies

Example Response	

```
[
  {
    "disabled": false,
    "disabledWhy": "",
    "name": "Demo 253",
    "restricted": false,
    "restrictedWhy": "",
    "studyId": 253
  },
  {
    "disabled": false,
    "disabledWhy": "",
    "name": "Acceptance Test Study",
    "restricted": false,
    "restrictedWhy": "",
    "studyId": 254
  }
]
```

Notes	Each study in the result is an element in a JSON array. For each study element, the following attributes are provided.

Attribute	Type	Description
disabled	boolean	True if study is disabled, false otherwise
disabledWhy	string	Reason why the study is disabled, blank if not disabled
name	string	Study name
restricted	boolean	True if study is restricted, false otherwise
restrictedWhy	string	Reason why the study is restricted, blank if not restricted

Attribute	Type	Description
studyId	number, 1 to 999	Unique study number

3.7.1.9. Study Status

Get the status of a particular study and keep study connection open for the session.

Request	`GET /studies/:study_num`
Example Response	```{ "readOnly": false, "studyId": 250 }```

3.7.1.10. Release Study

Release the study opened in current session and return the status of the study.

Request	`GET /studies?release`
Example Response	```{ "readOnly": false, "studyId": 250 }```

3.7.2. Study Setup

3.7.2.1. Logo

Get study logo image, base64 encoded

Request	`GET /studies/:study_num/logo`
Example Response	Binary format
Notes	Logo is a PNG image, with base64 encoding applied.

3.7.2.2. Lookup Table

Get a named lookup table

Request	`GET /studies/:study_num/lut/:lut_name`
Example Response	```[{ "code": "refax", "label": "corrections on refaxed CRF from a clinical site" }, { "code": "letter", "label": "corrections described in a letter from the clinical investigator"```

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```
    },
    {
      "code": "typo",
      "label": "data entry error correction"
    }
  ]
```

Notes   Special lookup table names include QC, QCNOTE, QCREPLY, REASON

3.7.2.3. Missing Map

Get missing values lookup

Request   `GET /studies/:study_num/missingmap`

Example
Response
```
[
  {
    "code": ".U",
    "label": "Unknown"
  },
  {
    "code": ".D",
    "label": "Not Done"
  },
  {
    "code": ".A",
    "label": "Not Available"
  },
  {
    "code": ".R",
    "label": "Not Relevant"
  }
]
```

3.7.2.4. Query Category Map

Get query category map

Request   `GET /studies/:study_num/querycategorymap`

Example
Response
```
[
    {
        "code": "1",
        "label": "Missing",
        "autoResolve": 0,
        "sortValue": 0
    },
    {
        "code": "2",
        "label": "Illegal",
        "autoResolve": 1,
        "sortValue": 0
    }
]
```

3.7.2.5. Visit Map

Get visit map

Request	GET /studies/:study_num/visitmap

Example Response	<pre>[
	  {
	    "dueDay": 0,
	    "label": "Screening Visits",
	    "missedVisitPlate": 0,
	    "optionalPlates": [102,101],
	    "overdueAllowance": 0,
	    "requiredPlates": [1],
	    "terminationWindow": "",
	    "type": "X",
	    "visitDateField": 13,
	    "visitDatePlate": 1,
	    "visitId": 0,
	    "visitIds": [
	      {
	        "end": 0,
	        "start": 0
	      }
	    ]
	  },
	  {
	    "dueDay": 0,
	    "label": "Baseline",
	    "missedVisitPlate": 0,
	    "optionalPlates": [102],
	    "overdueAllowance": 0,
	    "requiredPlates": [2,4,3],
	    "terminationWindow": "",
	    "type": "B",
	    "visitDateField": 9,
	    "visitDatePlate": 2,
	    "visitId": 1,
	    "visitIds": [
	      {
	        "end": 1,
	        "start": 1
	      }
	    ]
	  }
	]</pre>

	Visit Attribute	Type	Description
Notes	dueDay	integer	The number of days before/after the baseline visit that the visit is scheduled. The baseline visit must have a value of 0 and pre-baseline visits must have negative values.
	label	string	A short (maximum 40 character) textual description of the visit

Visit Attribute	Type	Description
missedVisitPlate	integer	Plate number which if received, indicates that the visit number coded on that plate was missed.
optionalPlates	array	Array of plate numbers for forms that may be completed on this visit, but are not required
overdueAllowance	integer	The number of days that a scheduled visit is allowed to be late. Visits are considered overdue if they have not arrived within this number of days following the visit due day
requiredPlates	array	Array of plate numbers for forms that are required to be completed on this visit
terminationWindow	string	For visit type W, a termination window is required and may be one of the following forms: - On yy/mm/dd - Before yy/mm/dd - After yy/mm/dd Between yy/mm/dd-yy/mm/dd fraction In each case, the date value uses the format that is defined as the visitDateField's format
type	single character	1 character code for the type of visit. Legal values are from Visit Codes.
visitDateField	integer	The data field number of the visit date on the visitDatePlate.
visitDatePlate	integer	The plate on which the visit date can always be found. This must be one of the required plates listed in the requiredPlates array.
visitId	integer	The unique visit number
visitIds	array	Defines visit ids (start-end, inclusive) for visits that occur multiple times. The client often handles this in the following manner: 1. Fill out form or group of forms for the first visit id in the range 2. Once that form is assigned a status, a new visit with the next id defined in the range appears

Visit Code	Meaning	Scheduled	Required
X	screening	no	If subject enters the trial (baseline arrives)
P	pre-baseline visit	yes	Before arrival of baseline visit
B	baseline	yes	Can be scheduled from a pre-baseline visit
S	scheduled follow-up	yes	scheduled from the baseline visit
O	optional follow-up	no	not a required visit
r	required by date of termination visit	no	before arrival of next visit
R	required by date of termination visit	yes	on termination if scheduled pre-termination

Visit Code	Meaning	Scheduled	Required
T	cycle termination visit	yes	scheduled from the baseline visit
E	early termination of current cycle		if early termination occurs
A	abort all cycles	no	if abort event occurs
F	final visit (terminates all cycles)	no	
W	study termination date window	yes	Date scheduling of final visit

3.7.2.6. Reports

Run study report and return JSON results

Request	`GET /studies/:study_num/report/:reportname`
Example Response	Each response has a context section, optional labels section and a results section

```
[
    {
        "context": {
            "args": {
            },
            "endTime": "2018-04-16T15:06:46.552",
            "reportName": "Enrollment by Site",
            "startTime": "2018-04-16T15:06:46.454",
            "studyId": 154,
            "studyName": "Generic 154"
        },
    "labels": {
        "country":"Country Code",
        "endDate":"End Date",
        "enroll":"Enrollment Target",
        "name":"Site Name",
        "siteId":"Site ID",
        "startDate":"Start Date"
    },
    "results":[{
        ...
        }]
    }
]
```

Notes	Each report has unique output content. To view the structure of the report output, run the report and save the result to HTML. Examining the HTML, the content is marked as data and embedded in the <script type="application/json" id="data"> tag.

3.7.2.7. Sites

Get site information for an entire study definition

Request	`GET /studies/:study_num/sites`
Example Response	

```
[
  {
    "name": "Hospital #1",
    "siteId": 10,
    "contact": "Person #1",
    "email": "test@dfnetresearch.com",
    "investigator": "PI #1",
    "investigatorPhone": "",
    "address": "100 Main St., Hamilton, Ontario",
    "telephone": "905-522-3282",
    "subjects": [
      {
        "end": 10999,
        "start": 10001
      }
    ]
  },
  {
    "name": "Hospital #2",
    "siteId": 20,
    "contact": "Person #2",
    "email": "test@dfnetresearch.com",
    "investigator": "PI #2",
    "investigatorPhone": "",
    "address": "15 North St., Hamilton, Ontario",
    "telephone": "905-522-3282",
    "subjects": [
      {
        "end": 20999,
        "start": 20001
      }
    ]
  }
]
```

Notes	Returns sites database with details, including subject ID ranges, for each site. For each such site, the following attributes are provided.

Attribute	Type	Description
name	string	Name of the site, clinic, hospital or institution
siteId	integer	Numeric value in the range 0-21460 inclusive, which uniquely identifting each clinical site participating in the study
name	string	Name of the site, clinic, hospital or institution
contact	string	Name of the primary contact. By default, Query Reports are addressed to the primary contact

Attribute	Type	Description
email	string	Space-delimited list of email addresses, used to deliver DFdiscover Query Reports. Each email address must start with the prefix mailto: followed by the complete email address.
investigator	string	The name of the principal investigator at the site.
enrollTarget	integer	Number of subjects that the site is expected to enroll.
address	string	Street address
telephone	string	Telephone number of the contact person
subjects	array	Subject ID lists or ranges (start-end, inclusive) available at each site. Each subject ID can belong to one and only one site. Is empty for the error monitor site.
country	string	3-character code from the ISO 3166-1 list of approved country codes. Useful for grouping by country
startDate	date in yyyy/mm/dd format	Date when site is expected to start, or has started, to enroll subjects
endDate	date in yyyy/mm/dd format	Date when site is expected to stop, or has stopped, enrolling subjects
effectiveDate[1-5]	date in yyyy/mm/dd format	Each Effective Date is the first date on which the matching version is in place at the site. Multiple Effective Date are expected to be in chronological order.
version[1-5]	string	A protocol version identifier. Paired with Effective Date, indicates when protocol
errorMonitor	boolean	Any data records with subject IDs that do not belong to one of the clinical sites are automatically assigned to the error monitor site.
replyTo	string	Email address of the person at this site who is designed to receive replies to Query Reports
testOnly	boolean	Is this site present for testing only? Do not include test sites in exports/reports

3.7.2.8. Setup Definition

Get setup information for an entire study definition

Request   GET /studies/:study_num/setup

Example
Response
```
[
  {
    "addPidEnabled": true,
    "autoReason": "per field",
    "dateRounding": "None",
    "level": 1,
    "levels": [],
    "multipleQC": false,
    "name": "Acceptance Test Study",
    "number": 254,
    "pidCount": 5,
    "plates": [
```

```
            ...
        ],
        "startYear": 1990,
        "studyHelp": "",
        "uniqueFieldNames": false,
        "viewModeEc": false,
        "yearCutoff": 1920
    }
]
```

The `plates` content is an array of 0 or more plates, each of which has a structure defined in Section 3.7.2.9, "Setup Plate".

3.7.2.9. Setup Plate

Get setup information for a specific plate

Request   GET /studies/:study_num/setup/plates/:plate

Example
Response
```
[
    {
        "arrivalTrigger": "",
        "description": "Blood Pressure Screening Visits",
        "eligibleForSigning": "Final",
        "help": "",
        "icr": "Standard",
        "moduleRefs": [
                ...
        ],
        "number": 1,
        "sequenceCoded": "First Data Field",
        "termPlate": false
    }
]
```

The `moduleRefs` content is an array of 0 or more modules, each of which has a structure defined in Section 3.7.2.10, "Setup Module".

3.7.2.10. Setup Module

Get module reference object for a particular plate

Request   GET /studies/:study_num/setup/plates/:plate/modules/:mid

Example
Response
```
[
    {
        "description": "Blood Pressure Readings",
        "fieldRefs": [
            ...
        ],
        "id": 5030,
        "instance": 2,
        "moduleId": 5022,
        "name": "BloodPressure",
```

```
            "number": 4
        }
]
```

The `fieldRefs` content is an array of 0 or more fields, each of which has a structure defined in Section 3.7.2.11, "Setup Fields".

3.7.2.11. Setup Fields

Get collection of field reference objects within a module for a particular plate

Request `GET /studies/:study_num/setup/plates/:plate/modules/:mid/fields/:fid`

Example
Response
```
[
    {
        "alias": "S2SBP1",
        "blinded": "No",
        "comment": "",
        "constant": false,
        "constantValue": "",
        "description": "Screen 2: Reading 1 systolic",
        "display": 3,
        "fieldEnter": "",
        "fieldExit": "MissingQC",
        "fieldId": 10159,
        "format": "nnn",
        "help": "Legal values are: $(legal)",
        "id": 10207,
        "legal": "60-300",
        "level": 0,
        "name": "SBP1",
        "number": 21,
        "onCrfRect": true,
        "plateEnter": "",
        "plateExit": "",
        "prompt": "",
        "reasonIfNonBlank": false,
        "rects": [
        {
            "h": 25,
            "w": 26,
            "x": 501,
            "y": 475
        }
        ],
        "required": "Optional",
        "skipCondition": "",
        "skipTo": 0,
        "store": 3,
        "type": "Number",
        "units": "mmHg",
        "use": "Standard"
    }
]
```

3.7.2.12. Edit Checks

Get edit checks binary (compiled editchecks)

Request	`GET /studies/:study_num/editchecks`
Example Response	Binary format

3.8. Study Data

3.8.1. Subject list

Get list of all subjects for the specified site that have records in the database

Request   `GET /studies/:study_num/sitesubjects/:site_id`

site_id is a required integer, equal to the siteId in the sites database

Example Response
```
[
  {
    "subjectId": 1001,
    "status": 1
  },
  {
    "subjectId": 1002,
    "status": 2
  },
  {
    "subjectId": 1003,
    "status": 2
  }
]
```

Notes   Returns summary detail, specifically status, for each subject at the requested site. Subjects are included only if they have at least one record in the study database.

Attribute	Type	Description
subjectId	integer	Unique subject identifier
status	integer	Subject status is one of the following values: 1 = final, 2 = incomplete, 3 = pending

3.8.2. Keys for Subject

Get list of all existing record keys (subject, visit, plate, status, and validation level) for a given subject.

Request   `GET /studies/:study_num/subjectkeys/:subjectId`

The unique subject ID, :subjectId, is required.

Example Response
```
[
  {
    "subjectId": 99001,
    "plate": 1,
    "status": 1,
```

```
      "level": 0,
      "visit": 0
    },
    {
      "subjectId": 99001,
      "visit": 1
      "plate": 2,
      "status": 1,
      "level": 0,
    }
]
```

Notes   The return result is a JSON array of record key objects with the following attributes.

Attribute	Type	Description
subjectId	integer	Unique subject identifier
plate	integer	Plate number
status	integer	Subject status is one of the following values: 1 = final, 2 = incomplete, 3 = pending
level	integer	Save level of record
visit	integer	Visit number

3.8.3. Keys Available by Site

Get list of all primary keys that exist for a given site

Request   `GET /studies/:study_num/sitekeys/:site_id`

site_id is a required integer, equal to the siteId in the sites database

Example
Response
```
[
    {
        "subjectId": 999001,
        "plate": 12,
        "visit": 50
    },
    {
        "subjectId": 999002,
        "plate": 12,
        "visit": 50
    }
]
```

3.8.4. Status for keys

Get ONE primary key (status: 0, 1, 2, 3) object, and zero or more secondary images keys (status: 4, 5, 6).

Request   `GET /studies/:study_num/keysinfo/:subject/:visit/:plate`

the :subject, :visit and :plate are all integer values and required

Example
Response
```
[
    {
```

```
            "arrival":"",
            "created":"2014-06-25T11:58:10",
            "firstArrival":"2018/09/20 15:14:42",
            "format":"",
            "lastArrival":"2018/09/20 15:14:42",
            "level":1,
            "modified":"2018-08-29T16:03:00",
            "pages":"0",
            "plate":2,
            "raster":"1426R0003008",
            "sender":"",
            "status":5,
            "subjectId":2002,
            "visit":1,
            "visitDate":"02/01/15"
        },
        {
            "arrival":"2018/09/20 15:14:42",
            "created":"2014-06-25T11:58:10",
            "firstArrival":"2018/09/20 15:14:42",
            "format":"png",
            "lastArrival":"2018/09/20 15:14:42",
            "level":1,
            "modified":"2018-09-24T11:16:40",
            "pages":"1",
            "plate":2,
            "raster":"1838/009Z001",
            "sender":"DFws Attach DOC:datafax:asset.PNG
%3Fid=7148A4A5-888D-49AC-9781-BC39DA88299E&ext=PNG",
            "status":2,
            "subjectId":2002,
            "visit":1,
            "visitDate":"02/01/15"
        }
    ]
```

Notes   For better performance load study's setup, sites, missingmap and visitmap:

1. /studies/:study_num/setup

2. /studies/:study_num/sites

3. /studies/:study_num/missingmap

4. /studies/:study_num/visitmap

3.8.5. Database Records by filter

Returns a record with filters for subjectId (id) or site. Records can also be filtered by modified_since timestamp to retrieve records modified on or after a given timestamp.

Request   GET /studies/:study_num/records?
               id={subject_id}&site={site_id}&modified_since={timestamp}

               the :subject_id, :site_id are integer values

modified_since is an optional ISO format timestamp (i.e. 2016-06-07, 2016-06-07T10:35:57). If this filter is provided, a site_id or subject_id parameter must be specified. This filter retrieves records that were modified on or after the given timestamp.

Example
Response

```
[
    {
        "created": "2018-09-12T17:32:36",
        "level": 1,
        "modified": "2018-12-11T12:56:20",
        "moduleData": [
            {
                "fieldData": [
                    {
                        "alias": "VISITNUM001",
                        "fid": 11155,
                        "fieldId": 10488,
                        "missingValue": "",
                        "name": "VISITNUM",
                        "value": "001"
                    },
                    {
                        "alias": "SUBJID001",
                        "fid": 11154,
                        "fieldId": 10485,
                        "missingValue": "",
                        "name": "SUBJID",
                        "value": "1001"
                    },
                    {
                        "alias": "VISDAT001",
                        "fid": 11156,
                        "fieldId": 10486,
                        "missingValue": "",
                        "name": "VISDAT",
                        "value": "29-AUG-2018"
                    },
                    {
                        "alias": "MHYN001",
                        "fid": 11159,
                        "fieldId": 11150,
                        "missingValue": "",
                        "name": "MHYN",
                        "value": "2"
                    },
                    {
                        "alias": "MHSPID001",
                        "fid": 11160,
                        "fieldId": 11153,
                        "missingValue": "",
                        "name": "MHSPID",
                        "value": ""
                    },
                    {
                        "alias": "CMYN001",
```

```
                            "fid": 11157,
                            "fieldId": 11149,
                            "missingValue": "",
                            "name": "CMYN",
                            "value": "2"
                        },
                        {
                            "alias": "CMSPID001",
                            "fid": 11158,
                            "fieldId": 11152,
                            "missingValue": "",
                            "name": "CMSPID",
                            "value": ""
                        },
                        {
                            "alias": "AEYN001",
                            "fid": 11161,
                            "fieldId": 11148,
                            "missingValue": "",
                            "name": "AEYN",
                            "value": "2"
                        },
                        {
                            "alias": "AESPID001",
                            "fid": 11162,
                            "fieldId": 11151,
                            "missingValue": "",
                            "name": "AESPID",
                            "value": ""
                        },
                        {
                            "alias": "LBYN001",
                            "fid": 11254,
                            "fieldId": 11243,
                            "missingValue": "",
                            "name": "LBYN",
                            "value": "0"
                        }
                    ],
                    "mid": 5153,
                    "moduleId": 5026
                }
            ],
            "permission": {
                "addQuery": true,
                "addReason": true,
                "approveReason": true,
                "attachDoc": true,
                "createData": true,
                "deleteData": true,
                "deleteQuery": true,
                "deleteReason": true,
                "ecAddQuery": true,
                "ecAddReason": true,
```

```
                "ecApproveReason": true,
                "ecDeleteQuery": true,
                "ecModifyQuery": true,
                "modifyData": true,
                "modifyQuery": true,
                "modifyReason": true,
                "replyQuery": true,
                "roleName": "unrestricted",
                "showHiddenField": true
            },
            "plate": 1,
            "raster": "1837R0007001",
            "screen": 1,
            "status": 1,
            "studyId": 17,
            "subjectId": 1001,
            "visit": 1
        },
        {
            "created": "2018-09-12T17:32:49",
            "level": 1,
            "modified": "2018-09-12T17:32:49",
            "moduleData": [
                {
                    "fieldData": [
                        {
                            "alias": "SUBJID002",
                            "fid": 10617,
                            "fieldId": 10485,
                            "missingValue": "",
                            "name": "SUBJID",
                            "value": "1001"
                        }
                    ],
                    "mid": 5033,
                    "moduleId": 5026
                },
                {
                    "fieldData": [
                        {
                            "alias": "IEYN",
                            "fid": 10619,
                            "fieldId": 10382,
                            "missingValue": "",
                            "name": "IEYN",
                            "value": "1"
                        }
                    ],
                    "mid": 5034,
                    "moduleId": 5015
                }
            ],
            "permission": {
                "addQuery": true,
```

```json
            "addReason": true,
            "approveReason": true,
            "attachDoc": true,
            "createData": true,
            "deleteData": true,
            "deleteQuery": true,
            "deleteReason": true,
            "ecAddQuery": true,
            "ecAddReason": true,
            "ecApproveReason": true,
            "ecDeleteQuery": true,
            "ecModifyQuery": true,
            "modifyData": true,
            "modifyQuery": true,
            "modifyReason": true,
            "replyQuery": true,
            "roleName": "unrestricted",
            "showHiddenField": true
        },
        "plate": 2,
        "raster": "1837R0007002",
        "screen": 2,
        "status": 2,
        "studyId": 17,
        "subjectId": 1001,
        "visit": 1
    }
]
```

3.8.6. Database record by keys

Get a record with the given set of keys - subject, visit and plate

Request   GET /studies/:study_num/records/:subject/:visit/:plate?allfields

Optional parameter allfields can be specified for new records which retrieves new record with all plate fields.

Example
Response

```json
{
    "created": "",
    "level": 0,
    "modified": "",
    "moduleData": [
        {
            "fieldData": [
                {
                    "alias": "VISITNUM001",
                    "fid": 11155,
                    "fieldId": 10488,
                    "missingValue": "",
                    "name": "VISITNUM",
                    "value": "1"
                },
                {
                    "alias": "SUBJID001",
```

```
            "fid": 11154,
            "fieldId": 10485,
            "missingValue": "",
            "name": "SUBJID",
            "value": "2001"
        },
        {
            "alias": "VISDAT001",
            "fid": 11156,
            "fieldId": 10486,
            "missingValue": "",
            "name": "VISDAT",
            "value": ""
        },
        {
            "alias": "MHYN001",
            "fid": 11159,
            "fieldId": 11150,
            "missingValue": "",
            "name": "MHYN",
            "value": "0"
        },
        {
            "alias": "MHSPID001",
            "fid": 11160,
            "fieldId": 11153,
            "missingValue": "",
            "name": "MHSPID",
            "value": ""
        },
        {
            "alias": "CMYN001",
            "fid": 11157,
            "fieldId": 11149,
            "missingValue": "",
            "name": "CMYN",
            "value": "0"
        },
        {
            "alias": "CMSPID001",
            "fid": 11158,
            "fieldId": 11152,
            "missingValue": "",
            "name": "CMSPID",
            "value": ""
        },
        {
            "alias": "AEYN001",
            "fid": 11161,
            "fieldId": 11148,
            "missingValue": "",
            "name": "AEYN",
            "value": "0"
        },
```

```
                    {
                        "alias": "AESPID001",
                        "fid": 11162,
                        "fieldId": 11151,
                        "missingValue": "",
                        "name": "AESPID",
                        "value": ""
                    },
                    {
                        "alias": "LBYN001",
                        "fid": 11254,
                        "fieldId": 11243,
                        "missingValue": "",
                        "name": "LBYN",
                        "value": "0"
                    }
                ],
                "mid": 5153,
                "moduleId": 5026
            }
        ],
        "permission": {
            "addQuery": true,
            "addReason": true,
            "approveReason": true,
            "attachDoc": true,
            "createData": true,
            "deleteData": true,
            "deleteQuery": true,
            "deleteReason": true,
            "ecAddQuery": true,
            "ecAddReason": true,
            "ecApproveReason": true,
            "ecDeleteQuery": true,
            "ecModifyQuery": true,
            "modifyData": true,
            "modifyQuery": true,
            "modifyReason": true,
            "replyQuery": true,
            "roleName": "unrestricted",
            "showHiddenField": true
        },
        "plate": 1,
        "raster": "0000/0000000",
        "screen": 0,
        "status": 0,
        "studyId": 17,
        "subjectId": 2001,
        "visit": 1
}
```

3.8.7. Database record by name

Get a record referenced by field name for the given set of keys - subject, visit and plate

Request   `GET /studies/:study_num/recordsbyname/:subject/:visit/:plate?allfields`

This request offers a simplified version of JSON record with only fields name and value pair, offering a simplified format to get and update records for only those fields which are modified. Optional parameter allfields can be specified for new records which retrieves new record with all plate fields.

Example
Response

```
{
    "created": "2018-09-12T17:32:36",
    "level": 1,
    "modified": "2018-12-19T22:18:34",
    "moduleData": [
        {
            "fieldData": [
                {
                    "name": "VISITNUM",
                    "value": "001"
                },
                {
                    "name": "SUBJID",
                    "value": "1001"
                },
                {
                    "name": "VISDAT",
                    "reasons": [
                        {
                            "code": "",
                            "created": "2018-12-19T21:46:51",
                            "createdBy": "datafax",
                            "field": 7,
                            "level": 1,
                            "modified": "2018-12-19T21:46:51",
                            "modifiedBy": "datafax",
                            "plate": 1,
                            "raster": "0000/0000000",
                            "status": 1,
                            "studyId": 17,
                            "subjectId": 1001,
                            "text": "Set by DFws Import",
                            "visit": 1
                        }
                    ],
                    "value": ""
                },
                {
                    "name": "MHYN",
                    "value": ""
                },
                {
                    "name": "MHSPID",
                    "value": ""
```

```
                },
                {
                    "name": "CMYN",
                    "value": ""
                },
                {
                    "name": "CMSPID",
                    "value": ""
                },
                {
                    "name": "AEYN",
                    "value": ""
                },
                {
                    "name": "AESPID",
                    "value": ""
                },
                {
                    "name": "LBYN",
                    "value": ""
                }
            ],
            "instance": 1,
            "name": "Common"
        }
    ],
    "permission": {
        "addQuery": true,
        "addReason": true,
        "approveReason": true,
        "attachDoc": true,
        "createData": true,
        "deleteData": true,
        "deleteQuery": true,
        "deleteReason": true,
        "ecAddQuery": true,
        "ecAddReason": true,
        "ecApproveReason": true,
        "ecDeleteQuery": true,
        "ecModifyQuery": true,
        "modifyData": true,
        "modifyQuery": true,
        "modifyReason": true,
        "replyQuery": true,
        "roleName": "unrestricted",
        "showHiddenField": true
    },
    "plate": 1,
    "raster": "1837R0007001",
    "screen": 1,
    "status": 1,
    "studyId": 17,
    "subjectId": 1001,
    "visit": 1
```

```
    }
```

3.8.8. Unlock

Release lock on data record with the given set of keys - subject, visit and plate

Request	`UNLOCK /studies/:studyNum/records/:subject/:visit/:plate` or `GET /studies/:studyNum/unlockrecord/:subject/:visit/:plate`
Example Response	```{ "subjectId": 99002, "plate": 1, "status": "OK", "visit": 0 }```

3.8.9. Lock

Acquire lock on data record with the given set of keys - subject, visit and plate

Request	`LOCK /studies/:studyNum/records/:subject/:visit/:plate` or `GET /studies/:studyNum/lockrecord/:subject/:visit/:plate`
Example Response	```{ "subjectId": 99002, "plate": 1, "status": "OK", "visit": 0 }```

3.8.10. Add/Update Record

Add or update a database record for the given set of keys - subject, visit and plate

Request	`PUT /studies/:study_num/records/:subject/:visit/:plate&utc` `PUT /studies/:study_num/recordsbyname/:subject/:visit/:plate&utc`
Notes	For better performance the following requests can be called before GET/POST/PUT records:

1. GET /studies/:study_num/setup

2. GET /studies/:study_num/sites

3. GET /studies/:study_num/missingmap

4. GET /studies/:study_num/visitmap

in any order. If error occurs in retrieving setup, sites and visit map, records cannot be retrieved, created or modified. Also retrieve missingmap, querycategorymap and lut/reason if specified in setup.

To POST/PUT record updates, first optionally retrieve the record to get the latest record: `GET ${PREFIX}/${VERS}/studies/:study_num/records/:subjectId/:visit/:plate` or `GET ${PREFIX}/${VERS}/studies/:study_num/recordsbyname/:subjectId/:visit/:plate` And then to save the record: `POST/PUT ${PREFIX}/${VERS}/studies/:study_num/records/:subjectId/:visit/:plate` or `POST/PUT ${PREFIX}/${VERS}/studies/:study_num/recordsbyname/:subjectId/:visit/:plate`

If the optional parameter `utc` is provided, the timestamps in the submitted data are interpreted as being in UTC. The database server will then update the time to server time.

3.8.10.1. Record Object

Attribute	Type	POST Body Argument	PUT Body Argument	Description
created	string	Generated	Generated	The ISO timestamp at which the record was created
modified	string	Generated	Generated	The ISO timestamp at which the record was modified
moduleData	array	Optional	Optional	Contains an array of moduleData objects (see Section 3.8.10.2, "moduleData Object")
subjectId	string	Required	Required	Subject identifier
permission	object	Ignored	Ignored	Data and metadata permissions for this record
plate	integer	Required	Required	Plate number
raster	string	Generated	Generated	Unique image identifier for the record
rasterlist	array	Ignored	Ignored	All images attached to this record
screen	integer	Generated	Generated	Record status from the coded values: 1=final, 2=incomplete, 3=pending. This record status repeats the status, excluding 7=delete.
status	integer	Required	Required	Record status from the coded values: 1=final, 2=incomplete, 3=pending, 7=delete.
studyId	integer	Required	Required	Study number
level	integer	Generated	Generated	Validation level of record. New records submitted via API are assigned a level of 1, otherwise, their previous value is not changed.
studyId	integer	Required	Required	Study number
visit	integer	Required	Required	Visit number

3.8.10.2. moduleData Object

Attribute	Type	POST Body Argument	PUT Body Argument	Description
fieldData	array	Optional	Optional	Contains an array of fieldData objects (see Section 3.8.10.3, "fieldData Object")
mid	integer	Required	Required	Unique numeric identifier for a module
moduleId	integer	Required	Required	The ID property of the root module that is referenced by the moduleRef. Provides a link between module references and the original module

3.8.10.3. fieldData Object

Attribute	Type	POST Body Argument	PUT Body Argument	Description
alias	string	Required	Required	Unique string that identifies the field across the entire study
fid	integer	Required	Required	Unique numeric identifier for the field

Attribute	Type	POST Body Argument	PUT Body Argument	Description
fieldId	integer	Required	Required	The ID property of the parent field that is referenced by the fieldRef. Provides a link between field references and the parent field.
queries	array	Optional	Optional	JSON array of queries on a particular field. Contains an array of query objects (see Section 3.8.10.4, "query Object")
reasons	array	Optional	Optional	JSON array of reasons on a particular field. Contains an array of reason objects (see Section 3.8.10.5, "reason Object"). Any reasons beyond the first are ignored/discarded
value	string	Required	Required	Value of field. Can be set to an empty string if no value is available.
missingValue	string	Optional	Optional	Missing value for field

3.8.10.4. query Object

Attribute	Type	POST Body Argument	PUT Body Argument	Description
category	integer	Required	Required	Query category code. Legal values are: 1=missing value, 2=illegal value, 3=inconsistent value, 4=illegible value, 5=fax noise, 6=other problem, 21=missing plate, 22=overdue visit, 23=EC missing plate, 30-99=user-defined category
created	string	Generated	Generated	ISO timestamp indicating when query was created
createdBy	string	Generated	Generated	DFdiscover username of query creator
field	integer	Generated	Generated	The data field to which the query is attached. This is the data field number - 3
level	integer	Generated	Generated	Validation level at which the query was created or last modified
modified	string	Generated	Generated	ISO timestamp indicating when query was modified
modifiedBy	string	Generated	Generated	DFdiscover username of query modifier
name	string	Generated	Generated	Description of the data field referenced by the query
note	string	Optional	Optional	Any additional text needed to describe the problem when it is resolved. Set to blank for a new query
page	string	Generated	Generated	Page number of the Query report, on which the query appears, or 0 if it has not yet been written to a report
query	string	Optional	Optional	Any additional text needed to clarify the issue to the person who receives the Query report. This is often set to the query category label
replied	string	Generated	Generated	ISO timestamp indicating when query was replied to
repliedBy	string	Generated	Generated	DFdiscover username who replied to the query
reply	string	Optional	Optional	The reply to a query. Should be blank when a new query is created, or when an old query is reset to new
report	string	Generated	Generated	The Query report number that the query was written to. The Query report number is always in the format yymmdd for the year, month, and day the report was created. If the query has not yet been written to a report, the value is 000000

Attribute	Type	POST Body Argument	PUT Body Argument	Description
resolved	string	Generated	Generated	ISO timestamp indicating when query was resolved
repliedBy	string	Generated	Generated	DFdiscover username who resolved the query
siteId	integer	Generated	Generated	Study site identifier
status	integer	Required	Required	Query status from the list of codes: 0=Pending (review), 1=New Query, 2=In report but not sent, 3=Resolved NA, 4=Resolved irrelevant, 5=Resolved corrected, 6=In report and sent, 7=Pending delete
studyId	integer	Generated	Generated	Study number
subjectId	integer	Generated	Generated	Subject identifier
type	integer	Required	Required	Query type from the list of codes: 1=Clarification, 2=Correction
use	integer	Required	Required	Query usage from the list of codes: 1=external use (these queries are formatted into a Query report and sent to the study site), 2=internal use only
value	string	Required	Required	Value of the data field when the query was created
visit	integer	Generated	Generated	Visit number

3.8.10.5. reason Object

Attribute	Type	POST Body Argument	PUT Body Argument	Description
code	integer	Optional	Optional	Coding of the reason for data change
created	string	Generated	Generated	ISO timestamp indicating when reason was created
createdBy	string	Generated	Generated	DFdiscover username of reason creator
field	integer	Generated	Generated	The data field to which the reason is attached. This is the data field number - 3
level	integer	Generated	Generated	Validation level at which the reason was created or last modified
modified	string	Generated	Generated	ISO timestamp indicating when query was modified
modifiedBy	string	Generated	Generated	DFdiscover username of query modifier
plate	integer	Generated	Generated	Plate number
raster	string	Generated	Generated	Raster name is always set to "0000/0000000"
status	integer	Required	Required	Reason status from the list of codes: 0=Pending (review), 1=approved, 2=rejected, 3=pending (default for new reason), 7=deleted
studyId	integer	Generated	Generated	Study number
text	string	Required	Required	Text that provides the reason for data change
subjectId	integer	Generated	Generated	Subject identifier
visit	integer	Generated	Generated	Visit number

Example 3.4. Example POST Request Body

```
Content-Type: application/json
```

```
{
          "subjectId": 1234,
      "visit": 50,
          "plate": 10,
      "status": 1,
          "moduleData": [
       {
          "mid": "111",
          "instance": "4",
                 "moduleId": "124",
                 "fieldData": [
                      {
                          "fid": "1245",
                          "fieldId": 1482,
                          "alias": "helloworld",
                          "value": "myanswer",
                          "queries": [
                             {
                                      "status": 1,
                                "category": "22",
                                "query": "this is a query",
                                "use": 1,
                                      "type": 1,
                                      "value": "myanswer"
                             }
                          ],
                          "reasons": [
                             {
                                "status": 3,
                                "text": "this is a reason for data change"
                             }
                          ]
                      }
                 ]
       }
    ]
}
```

Example 3.5. Example POST/PUT Response

```
{
  "created": "2009-04-15T15:08:58",
  "modified": "2016-08-25T21:13:55",
  "subjectId": 1234,
  "plate": 10,
  "status": 1,
  "study": 254,
  "level": 1,
  "visit": 50,
  "problemFields": [
      {
          "fid": 10196,
          "problem": "Query discarded: invalid  query 'type'",
          "valueToSave": "0"
```

```
        },
        {
            "fid": 10197,
            "problem": "Invalid Check/Choice code",
            "valueSaved": "0",
            "valueToSave": "9"
        },
        {
            "fid": 10200,
            "problem": "Decimal dropped",
            "valueSaved": "060",
            "valueToSave": "060.999"
        },
        {
            "fid": 10204,
            "problem": "Value too large",
            "valueSaved": "",
            "valueToSave": "0987654"
        },
        {
            "fid": 10213,
            "problem": "Invalid format",
            "valueSaved": "",
            "valueToSave": "05/03"
        }
    ]
}
```

Example 3.6. Example GET Response

```
{
  "created": "2016-07-20T15:15:03",
  "modified": "2016-07-20T15:15:03",
  "moduleData": [
    {
      "fieldData": [
        {
          "alias": "SBP1",
          "fid": 10382,
          "fieldId": 10159,
          "queries": [
            {
              "siteId": 99,
              "created": "2016-07-20T15:15:03",
              "createdBy": "datafax",
              "field": 9,
              "modified": "2016-07-20T15:21:55",
              "modifiedBy": "datafax",
              "name": "",
              "note": "",
              "page": "0",
              "subjectId": 99001,
              "plate": 5,
              "category": 1,
```

```
                "query": "",
                "raster": "0000/0000000",
                "replied": "",
                "repliedBy": "",
                "reply": "",
                "report": "000000",
                "resolved": "",
                "resolvedBy": "",
                "status": 1,
                "study": 254,
                "type": 1,
                "use": 1,
                "level": 1,
                "value": "",
                "visit": 21
              }
            ],
            "reasons": [
              {
                "code": "",
                "created": "2016-07-20T15:04:50",
                "createdBy": "datafax",
                "field": 9,
                "modified": "2016-07-20T15:04:50",
                "modifiedBy": "datafax",
                "subjectId": 99001,
                "plate": 5,
                "raster": "0000/0000000",
                "status": 1,
                "study": 254,
                "text": "This is another test.",
                "level": 1,
                "visit": 21
              }
            ],
            "missingValue": "",
            "value": "169"
          }
    ],
      "subjectId": 99001,
      "plate": 5,
      "raster": "1703/0001001",
      "rasterList": [
          {
              "fileName": "",
              "format": "png",
              "page": "1/1",
              "raster": "1526/0001001",
              "arrival": "2015-06-30T18:00:12",
              "sender": "iDataFax Import PDF:datafax",
              "status": "secondary"
          },
          {
              "fileName": "",
```

```
            "format": "mp4",
            "page": "1/1",
            "raster": "1633/0001001",
            "arrival": "2016-08-12T18:03:37",
            "sender": "iDataFax Attach DOC:datafax",
            "status": "secondary"
        },
        {
            "fileName": "dicom_dict.pdf",
            "format": "png",
            "page": "1/2",
            "raster": "1703/0001001",
            "arrival": "2017-01-19T19:22:33",
            "sender": "iDataFax Submit PDF:datafax",
            "status": "primary"
        },
        {
            "fileName": "dicom_dict.pdf",
            "format": "png",
            "page": "2/2",
            "raster": "1703/0001002",
            "arrival": "2017-01-19T19:22:33",
            "sender": "iDataFax Submit PDF:datafax",
            "status": "secondary"
        }
    ],
    "screen": 2,
    "status": 2,
    "study": 254,
    "level": 0,
    "visit": 21,
    "permission": {
        "addQuery": true,
        "addReason": true,
        "attachDoc": true,
        "createData": true,
        "deleteData": true,
        "deleteQuery": true,
        "deleteReason": true,
        "modifyData": true,
        "modifyQuery": true,
        "modifyReason": true,
        "replyQuery": true,
        "roleName": "wide open",
        "showHiddenField", true
    }
}
```

Example 3.7. Example POST/PUT Request Body for recordsbyname (records by field name)

```
{
  "moduleData": [
      {
          "fieldData": [
```

```
                {
                    "name": "VISDAT",
                    "value": "12-DEC-2018"
                }
            ],
            "instance": 1,
            "name": "Common"
        }
    ],
    "plate": 1,
    "status": 1,
    "studyId": 17,
    "subjectId": 1001,
    "visit": 1
}
```

Example 3.8. Example POST/PUT Response for recordsbyname (records by field name)

```
{
    "created": "2018-09-12T17:32:36",
    "level": 1,
    "modified": "2019-01-04T12:13:40",
    "plate": 1,
    "problemFields": [
        {
            "fid": 11156,
            "mid": 5153,
            "name": "VISDAT",
            "problem": "Value altered",
            "valueSaved": "12-DEC-2018",
            "valueToSave": "12-Dec-2018"
        }
    ],
    "status": 1,
    "studyId": 17,
    "subjectId": 1001,
    "visit": 1
}
```

Example 3.9. Example GET Response for recordsbyname (records by field name)

```
{
    "created": "2018-09-12T17:32:36",
    "level": 1,
    "modified": "2019-01-02T12:44:43",
    "moduleData": [
        {
            "fieldData": [
                {
                    "name": "VISITNUM",
                    "value": "001"
                },
                {
                    "name": "SUBJID",
```

```
                        "value": "1001"
                    },
                    {
                        "name": "VISDAT",
                        "reasons": [
                            {
                                "code": "",
                                "created": "2018-12-19T21:46:51",
                                "createdBy": "datafax",
                                "field": 7,
                                "level": 1,
                                "modified": "2018-12-19T21:46:51",
                                "modifiedBy": "datafax",
                                "plate": 1,
                                "raster": "0000/0000000",
                                "status": 1,
                                "studyId": 17,
                                "subjectId": 1001,
                                "text": "Set by DFws Import",
                                "visit": 1
                            }
                        ],
                        "value": "12-DEC-2018"
                    },
                    {
                        "name": "MHYN",
                        "value": ""
                    },
                    {
                        "name": "MHSPID",
                        "value": ""
                    },
                    {
                        "name": "CMYN",
                        "value": ""
                    },
                    {
                        "name": "CMSPID",
                        "value": ""
                    },
                    {
                        "name": "AEYN",
                        "value": ""
                    },
                    {
                        "name": "AESPID",
                        "value": ""
                    },
                    {
                        "name": "LBYN",
                        "value": ""
                    }
                ],
                "instance": 1,
```

```
                "name": "Common"
            }
        ],
        "permission": {
            "addQuery": true,
            "addReason": true,
            "approveReason": true,
            "attachDoc": true,
            "createData": true,
            "deleteData": true,
            "deleteQuery": true,
            "deleteReason": true,
            "ecAddQuery": true,
            "ecAddReason": true,
            "ecApproveReason": true,
            "ecDeleteQuery": true,
            "ecModifyQuery": true,
            "modifyData": true,
            "modifyQuery": true,
            "modifyReason": true,
            "replyQuery": true,
            "roleName": "unrestricted",
            "showHiddenField": true
        },
        "plate": 1,
        "raster": "1837R0007001",
        "screen": 1,
        "status": 1,
        "studyId": 17,
        "subjectId": 1001,
        "visit": 1
}
```

3.9. Document Management

For better performance load study's setup, sites, missingmap and visitmap:

1. /studies/:study_num/setup

2. /studies/:study_num/sites

3. /studies/:study_num/missingmap

4. /studies/:study_num/visitmap

3.9.1. Get Document

Get the details and data for the requested document having identifier image_id. Note that since the image_id can contain /
it must be encoded in the request using %2F. The image stored in data is base64 encoded.

Request	`GET /studies/:study_num/documents/:image_id`
Example Response	`[` `{`

```
        "data": "base64 encoding string...",
        "fileName": "DFlogin.png",
        "format": "png",
        "page": "1/1",
        "raster": "1704/000D001",
        "arrival": "2017-01-22T20:12:36",
        "sender": "DFweb Attach DOC:datafax"
        }
]
```

3.9.2. Add Document

Upload the document and add it to the record with the specified keys.

Request	`PUT /studies/:study_num/documents/:subject/:visit/:plate`
| PUT body | ```
{
    "fileName": "DFlogin.png",
    "format": "png",
    "page": "1/1",
    "raster": "1704/000G001",
    "arrival": "2017-01-23T10:49:26",
    "sender": "DFweb Attach DOC:datafax",
    "status": "primary"
}
``` |

3.10. User / Permission / Role Management

3.10.1. User Profile

Change current user's profile. The user profile information is a subset of the information known for a user account. The profile information can be changed by the user - other information requires admin privileges.

Request	`POST /contactinfo/:user_name`

POST body

Argument	Type	Description
affiliation	string	Affiliation
streetAddress	string	Street Address
city	string	City
state	string	State, Province or Region
postalCode	string	Zip or Postal Code
country	string	Country
phone	string	Telephone Number
fax	string	Fax Number

| Example Response | ```
{
    "message": "OK",
    "status": 200
}
``` |

3.10.2. Change Password

Change user's password. Must be the currently logged-in user, or administrator.

Request	`POST /password/:user_name`

POST body

Argument	Type	Description
password	string	New password for the user, base64-url encoded
passExpiryDaya	integer	Number of days until password expiry

| Example Response | ```
{
    "passExpiryDays": 180,
    "status": "OK"
}
``` |

3.10.3. User Account

Get the details of one or all user account(s). If the ":user_name" modifier is omitted, all user accounts are retrieved.

Request	`GET /users/:user_name`
| Example Response | ```
[
    {
        "administrator": "",
        "affiliation": "DF/Net Research Inc",
        "city": "",
        "country": "",
        "email": "",
        "fax": "",
        "fullName": "Ann Smith",
        "language": 0,
        "passwordExpiry": "2019-06-28",
        "phone": "",
        "postalCode": "",
        "receipt": 2,
        "routerAccess": false,
        "state": "",
        "status": 2,
        "streetAddress": "",
        "userName": "ann"
    }
]
``` |

3.10.4. User Roles

Get the roles assigned to a user.

Request	`GET /users/:user_name/userroles`
| Example Response | ```
[
    {
        "instance": 1,
``` |

```
        "subjects": 0,
        "roleId": 6,
        "sites": "*",
        "status": 2,
        "userName": "ann"
    }
]
```

3.10.5. Study Roles

Get the roles defined for a study.

| Request | GET /roles?study=:study_num |

Example Response
```
[
    {
        "DFdiscoverReports": "*",
        "autoLogoutDefault": 0,
        "autoLogoutMaximum": 0,
        "description": "",
        "DFexploreViews": "*",
        "roleId": 1,
        "status": 2,
        "study": 154,
        "studyReports": "*",
        "tasks": "",
        "tools": "*"
    }
]
```

3.10.6. Role Permissions

Get the role permissions for a role identifier.

| Request | GET /roles/:role_id/roleperms |

Example Response
```
[
    {
        "data": "1,2,3,4",
        "getLevels": "*",
        "instance": 1,
        "modifyLevels": "*",
        "plates": "*",
        "query": "1,2,3,4,5",
        "reason": "1,2,3,4",
        "roleId": 1,
        "showBlindedFields": true,
        "showInternalQueries": true,
        "status": 2,
        "visits": "*",
        "writeLevels": "*"
    }
]
```

3.11. Metrics

3.11.1. License Metrics

Get license usage information for the server.

Request	`GET /licensemetrics`

Example
Response

```
[
    {
        "adminInUse": 5,
        "adminMaxUsed": 5,
        "adminReserved": 5,
        "purchased": 30,
        "regularInUse": 6,
        "regularMaxUsed": 19,
        "rejected": 0,
        "startSince": "2017-07-07T09:33:40"
    }
]
```

3.11.2. Feature Metrics

Get feature metrics information for the server.

Request	`GET /featuremetrics`

Example
Response

```
[
    {
        "feature": "DFWS",
        "inUse": 1,
        "limit": 999,
        "maxUsed": 1,
        "rejected": 0
    },
    {
        "feature": "LS",
        "inUse": 0,
        "limit": 0,
        "maxUsed": 0,
        "rejected": 0
    }
]
```

Chapter 4. Administering DFws

This chapter guides a system administrator through the process of installing and starting the DFdiscover API server, DFws. The system administrator is expected to have ogood knowledge of administering a UNIX system.

4.1. Installing DFws

DFws is supported on Novell openSUSE version 13.2 and newer, Leap 42.1 and newer, SUSE Tumbleweed and Redhat Enterprise Linux up to version 7.2 or newer. DFws is a 64-bit server application - it installs on the 64-bit versions of any of these Linux distributions. It will not run on 32-bit systems. Other Linux distributions may work, but are unsupported. Debian distributions such as Ubuntu will not work at this time. CentOS and Oracle Linux are clones of RHEL and will work as expected.

Before installing DFws, comnfirm that the file descriptor limit is set to at least 65535. Confirm the current setting with the command:

```
# ulimit -a
```

The output will include a setting for `open files`. Update this value to 65535, by editing the system file, `/etc/sysctl.conf`. The setting in the file must be set to

```
fs.file-max=65535
```

If the setting is not present in the file, add it as a newline to the bottom of the file. If the setting is already defined and set to a higher value, do not change it. Otherwise, update it as indicated. If the file is changed, advise the system of the change with the command:

```
# sysctl -p
```

A complete installation requires approximately 370 Mb of free disk space for the software and documentation. The software is installed in `/opt/dfws`.

To install:

1. The DFws rpm is available from the DF/Net Research website, www.dfnetresearch.com, specificially software releases support website.

    Download the installation rpm, `dfws-5.1-0.x86_64.rpm`, to a suitable location on the local server.

2. Install the downloaded rpm. Change directories to the location where the rpm was downloaded. Assuming that you have downloaded the rpm to the `/tmp` directory,

    ```
    # cd /tmp
    ```

    followed by the appropriate command for your server OS type.

    On a RHEL/CentOS server:

    ```
    # yum --nogpgcheck install dfws-5.1-0.x86_64.rpm
    ```

    On openSUSE, use:

    ```
    # zypper --no-gpg-checks install dfws-5.1-0.x86_64.rpm
    ```

The software is installed in the `/opt/dfws` directory.

4.2. Configuration File (dfws.cf)

DFws is configured via properties in the `/opt/dfws/dfws.cf` file. The file location is fixed. In most cases, the contents will not need to be changed.

A semi-colon at the beginning of a line indicates that the line is a comment and is ignored as a configuration property. The configuration file includes the following:

```
;DFWS_PORT=4433
;DFWS_SSL_KEY=/opt/dfws/private.key
;DFWS_SSL_CERT=/opt/dfws/local.crt
;DFWS_DATABASE=/opt/dfws/dfws.db
DFWS_LOG_THRESHOLD=3
DFWS_MAX_SOCKET_THREADS=200
DFWS_MAX_PENDING_CONN=99
DFWS_SESSION_EXPIRY_CHECK=30
```

The configurable properties are as follows:

Configurable Property	Description
DFWS_PORT	Port number used to listen for requests. Default value = 4433. If DFws is installed on the same system as your DFdiscover server, do not use 443 as the `DFWS_PORT` port - this will disrupt the existing client / server communication.
DFWS_SSL_KEY	Server SSL private key file path. This should be set once and not changed. Default value is `/opt/dfws/private.key`.
DFWS_SSL_CERT	SSL certificate file path. This should be set once and not changed. Default value is `/opt/dfws/local.crt`.
DFWS_DATABASE	SQLite database file path. This should be set once and not changed. Default value is `/opt/dfws/dfws.db`.
DFWS_LOG_THRESHOLD	How much logging is performed? Options are 1=Critical (attempting to access API using valid API call but using invalid authorization credentials. Or attempting to steal session of another client), 2=Warning (critical errors and warnings that are in result of valid API call (such as Invalid JWT, or if session was forced closed by Admin), 3=Verbose (critical errors, warnings and problems including those where HTTP header or URI or API call are incorrect), 4=Info (all messages). Default is 3.
DFWS_MAX_SOCKET_THREADS	The maximum number of threads that can be allocated to process requests. Increasing the number of threads increases the ability to process more requests in parallel, but each for a shorter time. Suggested range is 20 - 200. Setting this value above the maximum suggested range may cause system instability. Default is 200.
DFWS_MAX_PENDING_CONN	When the system has allocated the maximum DFWS_MAX_SOCKET_THREADS, pending connections can be held by the operating system. Clients may still be able to connect after the DFws server has reached the maximum. Although DFws will stop accepting new connections, the operating system may still keep them in queue. Suggested range is 30 - 99. Default is 99.
DFWS_SESSION_EXPIRY_CHECK	For sessions that do not terminate normally, DFws will recover them after they expire. This value tells DFws how often to check. A shorter interval will recover expired sessions quicker but at the expense of spending more resources checking. Suggested range is 30 - 120 seconds. Default is 30.

If the configuration file is modified while DFws is running, send signal `SIGHUP` to the running DFws process - the signal is interpreted by DFws as a request to reload the configuration file. This will also reload the `DF_DEVELOPERS` table records.

To reload the configuration file after it is changed:

1. determine the process id, *pid*, of DFws:

```
# ps -ax | grep DFws
```

2. Send the SIGHUP signal to DFws:

```
# kill -HUP pid
```

4.3. DFws System Database (`dfws.db`)

While DFws is operational, it manages two tables in its system database. If not already present, the SQLite database *DFWS_DATABASE* is created with the required tables and default accounts. The database has two tables: one for API client accounts, DF_DEVELOPERS, and one for message logging, DF_LOG.

4.3.1. DF_DEVELOPERS (Table Definition)

API clients must be provided with login credentials (CLIENT_ID, CLIENT_PASS, CLIENT_SECRET and API server Base URI) to use the API.

The DF_DEVELOPERS table contains the following information:

Field	Type / Size	Description
DFDEVID	Integer	Numeric ID (Primary Key)
DFLOGIN	String (16)	Unique login name CLIENT_ID
DFPASSWD	String (50)	Password CLIENT_PASS
DFSECRETKEY	String (50)	Secret passcode CLIENT_SECRET
DFADMIN	Integer	Account privileges (0=client, 1=admin)
DFSTATUS	Integer	Account status (0 = disabled, 1=enabled)
DFEXPIRY	YYYYMMDDHHMMSS	Timestamp of account expiry
DFLASTACCESS	YYYYMMDDHHMMSS	Timestamp of last successful login

The DFws admin must create an account for each new API client by adding records to the DF_DEVELOPERS table. This is done using DFwsadmin. Typically, API clients are defined for one year. After creation, the DFws admin must also maintain the validity of each client by refreshing the expiry date.

The default datafax:passwd account is created by DFws on first launch, and is valid for 24 hours.

4.3.2. DF_LOG (Table Definition)

Configured by the value of the DFWS_LOG_THRESHOLD parameter, DFws logs key events such as unauthorized requests, invalid tokens or invalid requests to the DF_LOG table. The value is a code from the list: 0=Fatal, 1=Critical, 2=Warning, 3=Verbose, 4=Info. The specified value is cumulative so that each number includes itself and all lower numbers.

The DF_LOG table contains the following information:

Field	Type / Size	Description
DFTIMESTAMP	YYYYMMDDHHMMSS	Timestamp of log entry
DFTYPE	Integer	Type of log message reported (0=Fatal, 1=Critical, 2=Warning, 3=Verbose, 4=Info)

Field	Type / Size	Description
DFMESSAGE	String (150)	Text message
DFPEER	String (100)	IP address of the client system that sent the request
DFURI	String (150)	URI of the API request
DFMETHOD	String(10)	HTTP Method of the request (GET, POST, LOCK, UNLOCK, DELETE)
DFDEVLOGIN	String(16)	Client ID of the client that made the request
DFUSER	String(16)	DFdiscover username used to authorize the session
DFSTATUS	Integer	HTTP Response status code

DFwsadmin can be used to examine the contents of the table. There is also an API request available, see Log.

4.4. Starting and Stopping DFws

DFws is configured as a systemd service. Use **systemctl** to start and stop DFws and to enable the daemon to automatically restart on a system reboot. To start DFws:

```
# systemctl start dfws.service
```

To stop DFws:

```
# systemctl stop dfws.service
```

To enable automated start of DFws on reboot:

```
# systemctl enable dfws.service
```

To disable automated start of DFws on reboot:

```
# systemctl disable dfws.service
```

To determine the current status of DFws:

```
# systemctl status dfws.service
```

A running DFws server will process requests, encrypted using SSL, over the specified `DFWS_PORT` port. For DFws developers, the base URI to send requests is:

```
https://{SERVER_HOSTNAME}:{DFWS_PORT}/dfws/v5
```

4.5. Monitoring DFws Activities

Once DFws is available, your developers will expect that they can access it 24x7. While there is very little that requires active attention, it is important to monitor it on a regular basis. To most effective solition for monitoring DFws is the companion, command-line executable, DFwsadmin.

4.5.1. Using DFwsadmin

DFwsadmin is a command-line application that is installed with DFws. It is available for use by the system super-user on the DFws server.

DFwsadmin offers 3 broad types of interaction and information:

- Client account addition/deletion/update/review

- Log review and deletion

- DFws status

4.5.2. API Client Account Management

API client accounts are managed with the following commands:

```
usage: DFwsadmin add -client id -pass password -secret key
                [-status 1|0] [-admin Y|N] [-expiry days]
       DFwsadmin modify id [-client id] [-pass password] [-secret key]
                [-status 1|0] [-admin Y|N] [-expiry days]
       DFwsadmin delete id
       DFwsadmin show [-decode] [id]
```

4.5.2.1. Account Format

The API client accounts output has the following format:

```
CLIENTID|PASSWORD|SECRET|ADMIN|STATUS|EXPIRYDATE|LASTACCESSED
php_client|******|******|Y|Enable|20200102101541|20181231000000
nodejs_client|******|******|N|Disable|20200102092239|20181231000000
testapi|******|******|N|Disable|20200104092321|20181231000000
collectapp|******|******|N|Enable|20200111160239|20190111160239
webapp|******|******|N|Enable|20200111160336|20190111160336
```

- CLIENTID is unique login name for the API client

- PASSWORD is password for the API client

- SECRET is secret passcode for the API client to encode JWT tokens

- ADMIN is administrative privileges setting for the API client

- STATUS is client account status of being enabled or disabled

- EXPIRYDATE is the client account expiry date (YYYYMMDDHHMMSS)

- LASTACCESSED is the timestamp of last successful client log-in (YYYYMMDDHHMMSS)

4.5.3. Log Management

Activity on the DFws server is monitored with these commands:

```
usage: DFwsadmin showlog [-oldest|newest #] [-peer peer] [-client id]
                [-status status] [-contain message] [-type log_type]
                [-from date] [-to date] [-user username]]
       DFwsadmin clearlog [-oldest|newest #] [-peer peer] [-client id]
                [-status status] [-contain message] [-type log_type]
                [-from date] [-to date] [-user username]]
```

4.5.3.1. Log Format

The log output has the following format:

```
LOGDATE|TYPE|MESSAGE|PEER|URI|METHOD|CLIENTID|USER|STATUS
20190116153756300|3|Invalid API call|::ffff:192.168.4.223|/dfws/v5/logs|GET|||503
20190116153028603|1|Attempt to access session owned by another api-client:
 dfphp|::ffff:192.168.4.223|/dfws/v5/studies/154/records/1001/0/1|GET|DFweb||401
20190116150951215|1|Invalid authorization token|::ffff:192.168.4.223|/dfws/v5/authorize|
POST|dfphp||401
```

- LOGDATE format is YYYMMDDHHMMSSZZZ, where ZZZ is milliseconds (zero padded)

- TYPE is the type of log message reported, from the list 0=Fatal, 1=Critical, 2=Warning, 3=Verbose, 4=Info

- PEER is the IP address of the client machine that sent the request

- URI is the request sent by the client

- METHOD is the HTTP method of the request from the list: GET, POST, LOCK, UNLOCK, or DELETE

- CLIENTID is the ID of client sending the request

- USER is DFdiscover username used to authorize the session associated with current request

- STATUS is HTTP response status code (generally an HTTP error code) returned by API server for the request

4.5.4. System Status

To determine the current status of DFws, use the command:

```
usage: DFwsadmin apistatus
```

Output is one of:

```
DFws API server is not running.
```

or

```
DFws API server is running.
```

Additionally, information about the number of active client sessions is written to the system log in the following format:

```
Jan 16 10:52:40 dfws dfws.sh[108576]: INFO: Serving 10 active sessions.
```

Appendix A. Copyrights - Acknowledgments

A.1. External Software Copyrights

DFdiscover software uses several third-party software components as part of its server side and/or client tools.

The copyright information for each is provided below. If you would like to receive source codes of these third-party components, please send us your request at `<support@datafax.com>`.

A.1.1. DCMTK software package

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This software and supporting documentation were developed by

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A.1.16. c3.js

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A.1.17. d3.js

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